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Forest
Service

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Subject: Dwarf mistletoe in Tex Flat shelterwood unit, Minarets RD
(FPM Report No. C95-1)

To: Forest Supervisor, Sierra NF

A 40-acre shelterwood unit (Tex Flat Project; T6S, R23E, Sec 7) on the Minarets Ranger District was visited on October 27, 1994. Those present were Dan Young, District TMO and John Pronos, Service Area plant pathologist. The purpose of the visit was to evaluate the current status of dwarf mistletoe on the site and determine the most likely future effects of this pathogen.

OBSERVATIONS

The stand was located at 7200 feet elevation and consisted almost entirely of red fir. The site was shelterwood cut in 1972/73, which left an average of 12 trees/acre. Overstory trees are now 20 to 40 inches DBH and 100 to 180 feet tall. There is a layer of advanced reproduction that was left at the time of harvest plus a layer of seedlings and saplings that seeded in naturally after harvest.

Red fir dwarf mistletoe (Arceuthobium abietinum f. sp. magnificae) is present throughout the area. Overstory trees have the worst infection and are in the moderate to severe categories using the Hawksworth 6-Class Rating System. We did not see any overstory fir that were free of mistletoe although a few were only slightly infected. Mistletoe is already well established in the mid canopy of pole size and larger trees. Only the youngest trees which have seeded in since harvest are still disease free, although mistletoe is beginning to appear in this youngest class of trees. (See the "pest biology" description at the end of this report.)

DISCUSSION/MANAGEMENT

Dwarf mistletoe is one of the most studied and understood diseases of conifers in the western US. Decades of research have indicated that mistletoe can be maintained within acceptable levels through standard silvicultural treatments. Research has also demonstrated that left untreated, dwarf mistletoe gradually worsens, even though it may take many years to reach damaging levels. In early stages this parasite results in reduced growth and deformed trees. In later stages trees are weakened to the point that insects find them easy targets, resulting in tree death. The key for effective management is to implement treatments before the problem becomes severe. The longer dwarf mistletoe is ignored, the more drastic are the controls needed to manage it.





One of the worst situations for dwarf mistletoe is where infected overstory trees are left within or adjacent to young stands. This allows the most rapid spread and buildup of mistletoe in the small trees. Conifers infected throughout their lifetime rarely reach merchantable size.

The future effects of dwarf mistletoe on this stand will depend on what is or what is not done:

NO TREATMENT: Red fir stands with dwarf mistletoe in the overstory and understory slowly deteriorate over time as infections increase from light to moderate to severe. Growth of pole size and larger trees begins to slow down once infections reach moderate levels. Diameter growth of severely infected firs is generally 50 to 70% of uninfected ones. Ten-year mortality of heavily infected true firs is generally between 13 and 23%.

The only natural controls of dwarf mistletoe are high intensity stand replacing fires that destroy both the parasite and host. Unevenaged fir stands do not outgrow dwarf mistletoe and most trees infected at the seedling stage die before they reach commercial size. The long term effect of doing nothing will be the gradual loss of the entire stand.

DWARF MISTLETOE MANAGEMENT: Standard silvicultural treatments can be used to reduce the amount of mistletoe to levels that will allow reasonable growth and minimize mortality. It is not possible to maintain a healthy overstory and understory when both are infected with dwarf mistletoe. Uneven aged stand structures favor the most rapid buildup and spread of mistletoes. At Tex Flat the natural understory is just now beginning to show the effects of mistletoe infections. This is an ideal time to treat the stand so that dwarf mistletoe will not be a significant factor in the future management of the unit.

The most important step is to remove the infected overstory trees which are providing the source of infection for the understory. Once these trees are gone, it would be fairly straightforward to manage the unit. The advanced regeneration, primarily the infected pole size trees, will require some attention. It would be best to remove those poles that have more than one-half of the crown infected with mistletoe. Poles with less than one-half of the crown infected could be pruned during TSI entries. Once this is accomplished, normal silvicultural spacing guides that foster good height growth will be adequate to keep mistletoe effects minimal. In other words, it is not necessary to continually target infected trees for removal during future stand entries once the initial sanitation is completed.

John Pronos

JOHN PRONOS
Plant Pathologist





PEST BIOLOGY

Red Fir Dwarf Mistletoe

Red fir dwarf mistletoe, Arceuthobium abietinum f. sp. magnificae, is a seed-bearing plant that parasitizes only red fir. It will not survive without living host tissue, which it depends on for support, food, nutrients, and water.

Dwarf mistletoes initiate their life cycle when a seed lands on a needle or small twig of a host. The seed is coated with viscin, a sticky substance that allows it to adhere to the host tissue. During rains, the viscin becomes mucilaginous, allowing the seed to slide down to the needle base where it may lodge. The seed germinates in the winter or spring and the radicle grows along the twig until it reaches a needle base or bark irregularity. The radicle forms a holdfast and penetrates the twig into the xylem. A type of root system then develops in the twig. In 3 to 5 years from seed deposition, most successful infections will appear as branch swellings and will bear mistletoe shoots. These shoots will not produce fruit until at least 5 years following seed deposition, the average being 8-9 years. Fruit mature in the fall and disseminate seed in September and October. The seeds are explosively discharged from the fruit through the buildup of turgor pressure. Seeds normally have an upward trajectory.

Red fir dwarf mistletoe does not spread rapidly following establishment. Vertical spread in a tree averages less than 3 inches per year. Horizontal spread in a stand without overstory infection is also quite limited. The dense foliage of red fir limits spread because of the high probability of interception of the seed. Spread from infected overstory to understory may be up to about 100 feet, but it is usually less; the actual distance is dependent on slope, wind, and other factors. Trees less than 3 feet tall have a very limited chance of infection because of their small target size.

The effects of this mistletoe on tree growth and mortality relative to the Hawksworth 6-Class rating system are shown below. Source: Hawksworth, F.G., et. al., 1992. Interim dwarf mistletoe impact modeling system - users guide and reference manual. USDA Forest Service, Forest Pest Management, Methods Application Group, Fort Collins, CO, Report MAG-91-3, 90p.

HAWKSWORTH DWARF MISTLETOE RATING

	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
10-YEAR GROWTH LOSS (%):	0	0	0	2	5	30	50
10-YEAR MORTALITY (%):	0.0	0.7	2.3	5.0	8.8	13.5	19.2

